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Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER & SYSTEMS COMPANIES — WORLDWIDE

NOVEMBER 1, 1988

REDISCOVERING AMERICA

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Preparing to deal with Reagan's successor PAGE 16

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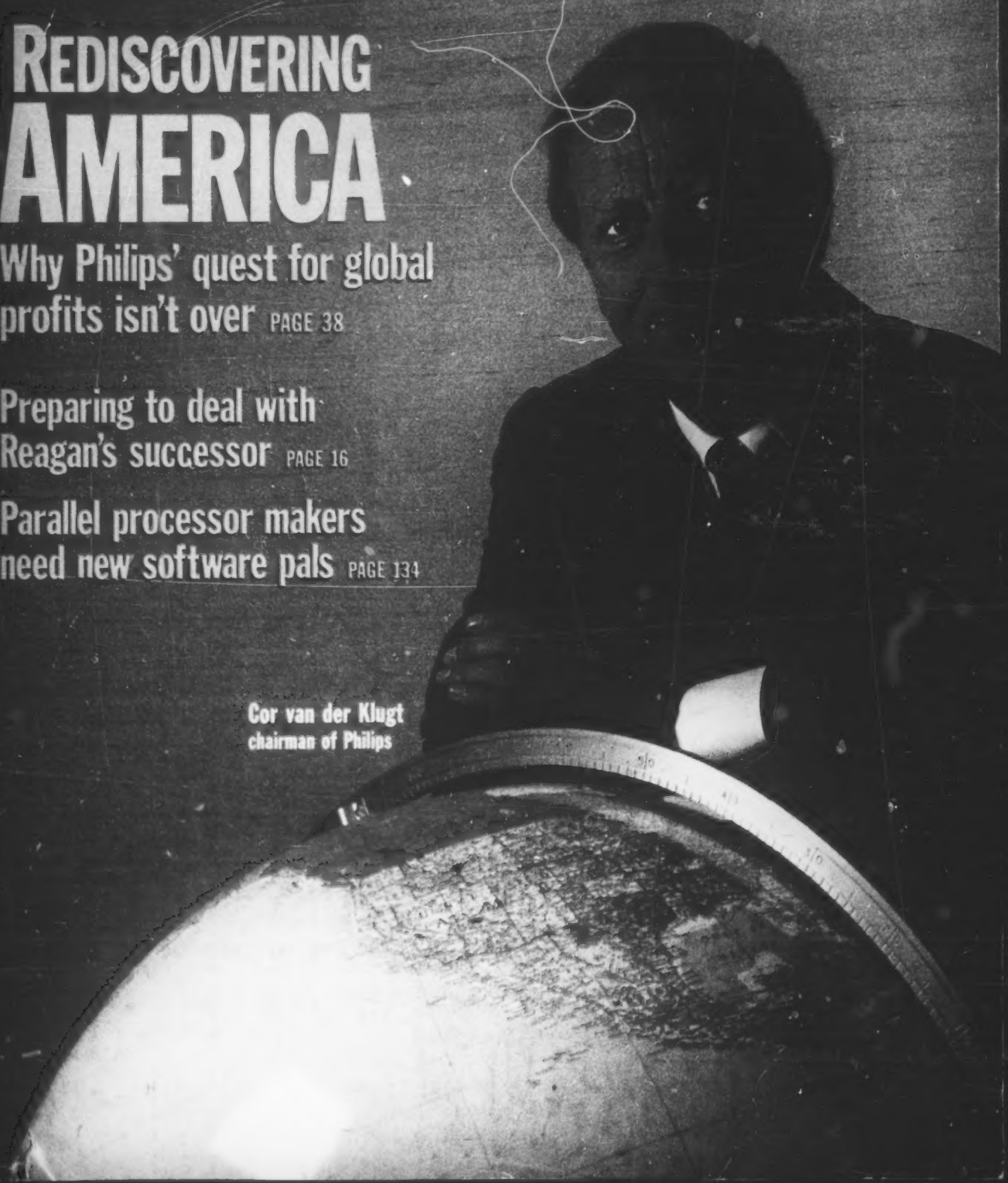

Cor van der Klugt
chairman of Philips

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES—WORLDWIDE

VOL. 14, NO. 21 November 1, 1988

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Dutch colonial

Perhaps the Dutch settlers should never have sold Manhattan. That's what Cor van der Klugt, chairman of the giant Philips electronics empire, recently told contributing editor Jack Gee.

Van der Klugt was being flippant, of course — using the historical reference to platform a plea for free trade. The Dutch, after all, were perhaps the most mercantile of all nations three and four centuries ago.

But perhaps the Philips chief is right. Had the Dutch held onto New Amsterdam, as The Big Apple was then known, perhaps his $25 billion corporation would have cut a better profile — and better profits — in U.S. electronics markets. As van der Klugt freely admits in our cover story, Philips has to . . . rediscover America: "Unless we have strength in the U.S., we will not be able to compete globally," he concedes.

In a lengthy and exclusive interview, van der Klugt discusses everything from Philips' restructuring plans to the need for standards in the CD-ROM storage technology pioneered by the Dutch electronics colossus. We're sure that anyone with a global perspective of this industry will find van der Klugt's views fascinating.

Anne Knowles, senior editor

Parallel software, please

The buzzwords are going mainstream: we're hearing terms like "fine-grained" and "massively parallel" more and more. That's the language of the parallel-processor world. But as senior editor Anne Knowles explains in her thoughtful story on the parallel-processor market, there's another language that makers of multiprocessor computers need to learn: the language of software that will run on any of their speedy machines.

After Reagan

With presidential election day just a week away, the media is riveted to every sneeze the candidates make. And we're hard-pressed to find any electronics executives who have any intentions of backing Dukakis — except for Sun Microsystems' cofounder Bill Joy, that is. Regardless of who gets the vote, though, the electronics industry has to prepare for a change of the White House guard. We asked Washington-based contributing editor Marty Chase to watch how the lobbyists are changing tactics to ensure that the U.S. electronics voice is heard as loudly as before.

JOHN KERR, managing editor

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BPA ABP

Why new telecom talk has National and AMD tingling

There's promise of a $2 billion plus market for chips when users adopt ISDN in earnest. But that's at least five years off

It's not a household word yet, but the Integrated Services Digital Network (ISDN), a new telecommunications standard for sending voice *and* data down existing phone lines, is already taking the telecom industry by storm.

With the advent of ISDN comes a potentially huge market for semiconductor vendors, eager to exploit this practically virgin telecommunications territory. From PC boards replacing soon to be obsolete modems, to central office switching equipment and handsets, the opportunities for semiconductor vendors seem endless.

That's why at least 20 major chip makers, including Fujitsu Ltd., Intel Corp., Motorola Inc., National Semiconductor Corp., SGS-Thomson and Siemens AG, have announced their intentions to enter the fray, and several are now shipping products.

But don't think this is a big market yet. Although European nations are further along with pilot ISDN installations than the United States, optimistic market estimates put worldwide ISDN chip sales for 1988 at a scant $15 million. That compares with a total communications-specific components market of about $700 million, according to market researcher Dataquest Inc. Wags point out that ISDN also stands for "I Still Don't Know."

The biggest cloud on the horizon concerns when ISDN will penetrate its first target market: businesses. It is now in field trials in 19 cities in the United States, according to Dataquest analyst Roger Steciak, and he says the standards —now being debated by a number of worldwide committees — are mostly set. But fewer than 100,000 ISDN lines have been installed nationwide, according to Fujitsu America Inc. estimates, so not many ISDN handsets and terminals are up and running —and obviously not many chips are being sold. Even the pro-ISDN market watchers agree that no one is going to make any money for at least five years.

ISDN chip sales growth

ISDN chips could make up over a quarter of all communications-component business in 10 years

But ISDN demand should begin to stir semiconductor sales after that. By 1992, claims Dataquest, the annual worldwide market for ISDN chips could be worth $300 million. But the real growth spurt may not be until the late 1990s, when Dataquest estimates ISDN component sales could top $2 billion — perhaps over a quarter of the total communications-specific components market.

Given that, "the question is how much to invest and how long to invest," AT&T's communication devices product manager Lynn Ditty notes. "ISDN has been slow to take off. The standards have taken a while to agree to."

Ma Bell's merchant move

AT&T has made a "sizable investment in the market," although some critics question whether its merchant ISDN push is really important to the vertically oriented communications giant. Ditty acknowledges that internal need for chips is "high, but it is important that we have a presence in the merchant market. We want to see ISDN succeed as a standard."

What's keeping other big chip companies heavily involved in the market are some signs of end-user interest and acceptance of ISDN. ISDN equipment maker Fujitsu has noticed an optimistic change in buying patterns over the last year. "We aren't pushing the market anymore," says communications product manager Dean Wolf. "We are really feeling the pull." ISDN handsets and terminals and PC add-in boards are the big sellers now, he says.

With ISDN acceptance leading in Europe — particularly in West Germany, where an upgrading of digital switches should be available to 85,000 users by 1990 — it's not surprising that major U.S. chip vendors are joining hands with their European counterparts. National, partnered by SGS-Thomson, keeps corporate interest high by talking to end users in MIS departments of *Fortune* 500 companies. The company is also unabashedly ambitious: "We have made a significant investment in time, people and money," says communications product manager Gary Johnson. "We have invested heavily for leadership. We are not in it for second or third place."

Advanced Micro Devices Inc. is equally eager: through its partnership with Siemens, it claims that the duo has the edge, since it has been in development with ISDN since 1981, with something like 100 to 150 man years invested.

But for small companies, the strategies must be different, as big profits in five years will not pay the bills now.

Cirrus Logic Inc., for example, has developed a high performance part for the computer arena that "can be extended to include high-performance processing of ISDN," says president Michael Hackworth. "It's irresponsible to risk investors' money by depending on ISDN revenues in the short term," he says.

And start-up Level One Communications Inc. plans to be set whichever way the market goes, according to technology vice president Francois Creppin. Creppin says the company is now selling into the pre-ISDN market and can sell both ISDN and pre-ISDN parts in the future. If ISDN doesn't evolve as planned, the company "will continue to be a major supplier in the voice/data arena," he says.

VALERIE RICE

Building a better mouse market

Microsoft leads the pack, with plans to ship 1.5 million mice this year — half of the total 3 million high-tech critters sold

When Webster's published the latest edition of its *Collegiate Dictionary*, it added a new meaning for the word "mouse." In addition to being a small rodent, a timid person and a dark-colored swelling caused by a blow, a "mouse" was recognized as "a small, mobile manual device that controls movement of the cursor on a computer display." Indeed, the continuing explosion in demand for this new breed of mice has made this definition of mouse a household word.

Apple Computer Inc. popularized the non-rodent variety, making them standard on the Macintosh models. But in the PC world, mice are only now starting to have a major impact. Until the relatively recent advent of desktop publishing and operating systems that make use of pointing devices, the major stumbling block to sales in the PC arena was the fact that only about 250 to 300 of the more than 20,000 major MS/DOS applications programs actually needed a mouse.

Old-time PC users and developers alike denigrated mice, with Seymour Rubenstein, developer of WordStar, the first major PC-based word-processing program, once saying that mice would become popular when people grew a third hand. They were wrong.

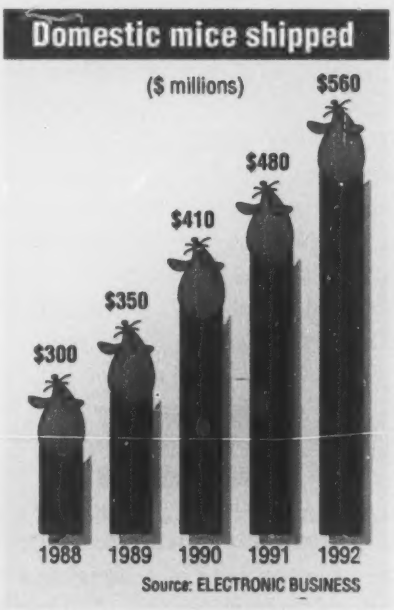
Today, many programs, including Microsoft Corp.'s Excel spreadsheet and the DOS 4 and OS/2 operating systems, rely on mice for added speed and convenience, and Dataquest, a San Jose-based research firm, predicts that 50% of all computers will have alternative pointing devices by 1991, compared with today's 10% installed base.

Mice are proliferating. More than 3 million units will be sold by the end of this year. And Dataquest predicts demand will grow 17% a year in the near-term. Dataquest is confident that with an expected average 60% annual increase in CAD software sales between 1987 and 1990, and a 23% annual increase in the business graphics market, mice will be popular long before people grow a third hand.

The Big Three

According to Fremont, California-based MSC Technologies Inc., nearly two dozen companies are breeding mice. Microsoft, MSC, and Logitech Corp. are the market leaders, with the three competitors all selling through distributor, retail, and OEM channels. With 1.5 million mice expected to be shipped this year, Microsoft accounts for half the mouse market. Increasing competition will ultimately decrease Microsoft's market share, according to Michael Goulde, director of the Norwell, Massachusetts-based CAP International Corp. Information Systems Division, but the market leader will continue to increase sales volume as the market expands.

Microsoft's initial 1983 marketing push was designed merely as an introduction to the use of mice on PCs. "We took an evangelistic role at the beginning," says Rich Able, Microsoft's group product manager for hardware. But now the Redmond, Wash., firm is focusing on improving awareness of its own upscale mouse. Microsoft's current marketing strategy, according to Abel, is to "position our mouse as a premium product and bundle it with various applications programs, such as Windows or Microsoft Paintbrush [a graphics program]."



Mice were originally developed at the Xerox Palo Alto Research Center. Conventional mechanical mice, such as those produced by the Japanese Alps Electric company and sold under the Microsoft and IBM labels, operate on any flat horizontal surface, relying on friction to activate small mechanical sensors.

With sales of over 500,000 units, MSC Technologies emphasizes the technological advantage of their PC Mouse, whose high resolution (up to 2,000 dots per inch versus 300 dpi for most mechanical mice) optical mouse, has no moving parts.

Another innovative mouse is the Manager Mouse from The Torrington Co. of Torrington, Conn. The $229 mouse without a tail can operate up to four feet away from its infrared sensor. Niche companies like Torrington rely on technical innovation in their marketing battle with the giant Microsoft.

The Macintosh is the other major user of mice, with a 100% penetration, but that computer comes with the Apple mouse, greatly reducing the third-party market.

Choices

Most mice are of the two- or three-button variety, offering, respectively, three- and seven-key combinations. IBM and Microsoft sell two-button mice, while most others use three buttons. The three-button mouse, considered confusing to many users, is mostly intended for those needing the extra keys for CAD or desktop publishing.

Although every mouse manufacturer touts its technology as the best, experts say all mice seem to work about equally well. However, important factors in choosing a mouse are: how they feel in the hand, number of buttons, compatibility and resolution.

JOHN McCORMICK

Since 1985, Amdahl has bested IBM at its own mainframe game. But IBM's ESA operating system and planned "Summit" architecture may soon change that

Can Amdahl always follow Big Blue's zig-zags?

BY ANNE KNOWLES

Is E. Joseph Zemke, president of Amdahl Corp., intimidated by IBM?

You bet he is. "IBM's a $60 billion company, and if they wanted to start a bloody price war, they could bring the U.S. government to its knees," says the 46-year-old executive who competes with Big Blue in the $15 billion mainframe computer market.

That's fear and loathing on IBM's trail. As the leading plug compatible mainframe (PCM) manufacturer, Amdahl, which recorded revenue of $1.5 billion in 1987, lives in Big Blue's shadow, vulnerable to its every whim, and dependent upon its every move. E. Ted Springstead, Amdahl's senior vice president, marketing operations, puts it another way: "When IBM zigs, we zig."

But that is the nature of its business. The Sunnyvale, Calif., manufacturer, in which Fujitsu Ltd. holds a 44% stake, has been playing catch-up with IBM ever since it began selling IBM-compatible mainframes 13 years ago. Amdahl has had its ups and downs in that time (see chart), but in the past two years it has hit its stride. And for the first time in the PCM market's history, Amdahl has turned the tables on IBM, forcing Big Blue to play catch-up, too.

Amdahl has established itself as a credible alternative to IBM in what is IBM's most lucrative market. It has done so using tactics that any electronics manufacturer can understand: a commitment to quality that comes from the top office, coupled with fiscal conservatism and a marketing stance that exploits attractive add-ons to differentiate Amdahl's computers from IBM's. The PCM maker has also achieved these goals with leverage that not many companies in the United States can enjoy: a majority equity stake plus engineering support from a Japanese electronics giant.

The specifics of Amdahl's achievements are intriguing. For example, the company announced its new family of mainframes before IBM did. Amdahl, which by necessity must outperform and underprice IBM's systems, usually allows IBM to go first so it can be sure to maintain its price/performance edge. But in May, Amdahl unveiled its 5990 series a full two months before IBM announced its comparable 3090 S series of systems. And when IBM's systems came out priced very aggressively, Amdahl quickly responded. Less than a week later, the company announced price reductions of up to 17% on its machines.

That priced its top-of-the-line 5990-1400 at $11.3 million, 10% lower than IBM's 3090 600S, and decreased its cost per MIPS (millions of instructions per second) to a record low of $99,000. "With these changes," says John C. Lewis, Amdahl's chief executive officer and chairman of the board, "our 5990-1400 processor continues to be the price/performance leader, in addition to being what we believe is the most powerful computing system available in the System/370-compatible marketplace."

Amdahl has also cracked some of IBM's bread-and-butter accounts. In two years, the company has doubled its number of *Fortune* 500 accounts,

Healthy respect for Big Blue from Amdahl president Joseph Zemke: "IBM could bring the U.S. government to its knees"

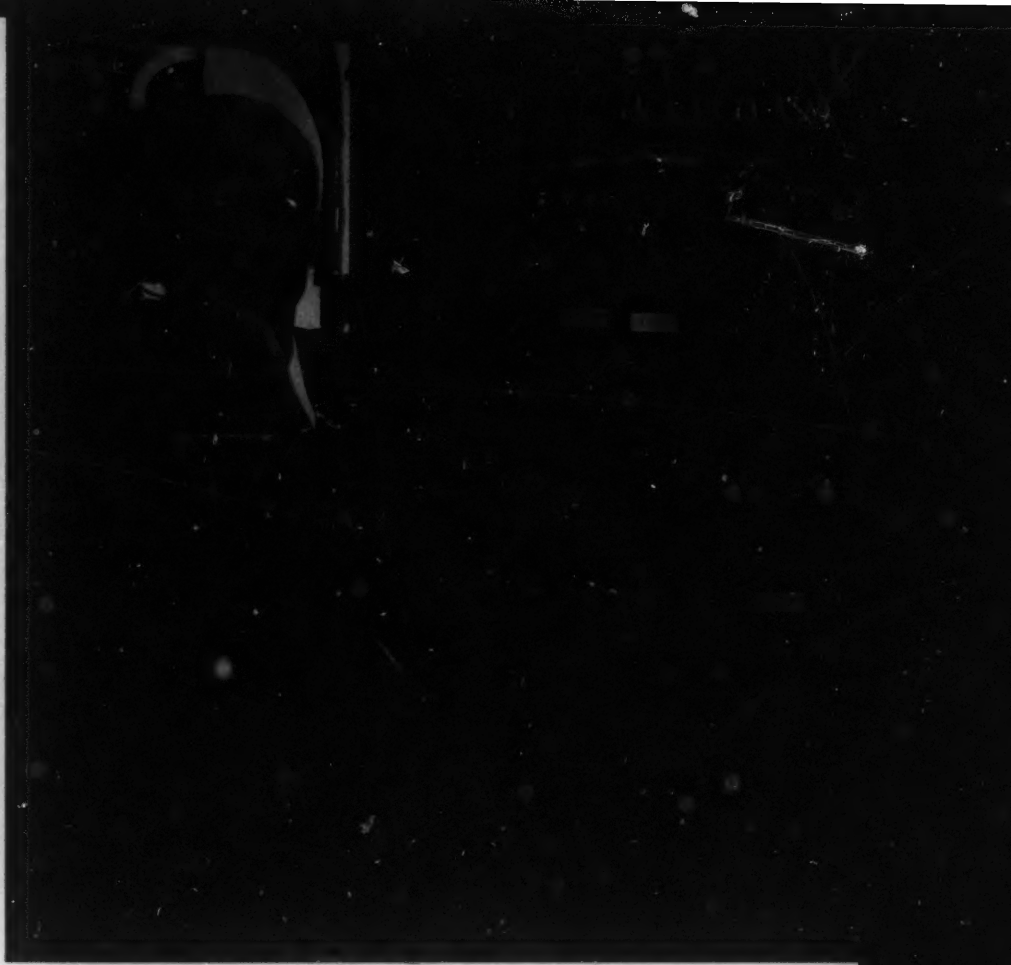
Christopher Springmann

from 12 at the end of 1985 to 26 at the end of 1987. And in the first half of this year, says Zemke, Amdahl increased its installations at new customers and new sites of existing customers by 44%.

Also, in 1987 the PCM maker broke the billion-dollar mark, raking in $1.5 billion in revenue. Meanwhile, analysts project Amdahl will increase its revenue another 21%, to $1.83 billion, and up its net income about 64% to $240 million.

Profitability looks solid: the company's gross margins were 47% of sales in its second fiscal quarter this year, says Edward F. Thompson, chief financial officer, and are expected to hover between 45% and 50% for the remainder of the year.

In the process, Amdahl has gained market share at IBM's expense. However, estimates vary. According to International Data Corp., a market research firm in Framingham, Mass., Amdahl's share of the $14.3 billion PCM market in 1986 was 5.2%, while IBM's was 91.6%. In 1987, according to IDC, IBM's share dropped to 88.6%, while Amdahl's piece of the $15.2 billion market grew to 7.4%. According to a mainframe user survey conducted jointly each year by Boston-based investment firm Cowen & Company and *Datamation* magazine, Amdahl's share of the installed base of PCMs doubled in one year, from under 7% in early 1987 to just under 14% earlier this year.



Watching out for the next zag: "When IBM zigs, we zig," says Amdahl's marketing chief Ted Springstead

Now, Amdahl is back in line following IBM. Currently, the company is working on upgrading its machines so they can run IBM's newest version of MVS, its mainframe operating system, called Enterprise Systems Architecture/370 (ESA). (Amdahl does not provide IBM software. Its systems are compatible with IBM's machines at certain hardware and software interface levels. But Amdahl customers must license MVS from IBM and Amdahl must retrofit its existing machines to run any new version of the operating system.)

IBM started shipping ESA to its customers in July, a month early. Amdahl received its copy of ESA in mid-June. And many analysts think it will be the third quarter next year before Amdahl can start upgrading its systems, enabling them to run the new operating system.

But ESA is presenting more work than Amdahl had expected. In the second quarter, after receiving the specifications for ESA, Amdahl increased its engineering change reserve — the fund used for redesigning existing systems — because ESA, Zemke says, affects more boards within Amdahl's machines than the company had predicted. Zemke will not divulge the amount added to the fund, but concedes the ante may have to be upped again.

Most observers, though, are confident ESA will not create any hurdles for Amdahl. In 1981, IBM revamped MVS. That conversion, called MVS/XA, was a more difficult technical feat. Amdahl was forced to change existing address space to 31 bits from 24 bits. ESA, on the other hand, uses 31 bits.

"ESA is similiar to the situation with MVS/XA," says Kenneth W. Simmonds, president of Teradata Corp. and a former Amdahl executive vice president. "From a technical point of view, it is not a problem." The potential pitfall, explains the Amdahl 10-year veteran, "is that their version will be later. It may affect short-term decisions."

In 1982, before Amdahl was able to respond to MVS/XA, its revenue plodded up 4% while its net income plummeted 75% to $6.76 million. In 1983, though, the company rebounded, increasing revenue 68% to $777.7 million, and net income 587% to $46.46 million.

That is exactly why Amdahl jumped into the storage business in 1982, according to Don Bellomy, an analyst with IDC. "It insulates them a bit," says Bellomy. "The margins aren't as good because they buy directly from Fujitsu." But IBM-compatible direct storage access devices (DASD) have smoothed out the company's revenue stream during down cycles in its mainframe business.

In two years, Amdahl has doubled the number of its *Fortune* 500 accounts

Amdahl entered the DASD market at an opportune time, says Rick Martin, an analyst with New York City investment firm Sanford C. Bernstein & Co. Martin says competitors, like Control Data Corp. and Memorex, were getting away from the business and potential competitors like Storage Technology Corp., were not off the ground yet. In the six years since Amdahl entered the DASD market, storage devices have grown to about 20% of sales.

Amdahl did not get into Unix for the same reason, says Zemke. The company began offering UTS, its version of Unix, two years ago. Amdahl has about 200 licenses for the operating system; half are at AT&T, Amdahl's largest customer. And a number of them run on IBM mainframes, says Dennis Stein, processor product marketing manager.

Zemke says UTS is not an attempt, as some believe, for Amdahl to get out from under IBM's shadow. "There are people who have suggested that with Unix we're really looking for a way to get away from the compatibility business and that's nonsense," claims Zemke. "The compatibility business has made us a billion and a half dollar company."

But UTS may provide an entrée into the scientific and engineering market. Amdahl's vector processors, bought from Fujitsu, are designed for compute-intensive environments. But so far they have contributed little to Amdahl's bottom line. UTS, and a joint development/joint marketing

Christopher Springmann

agreement with workstation maker Sun Microsystems Inc., may be more enticing to that market.

Future hurdles

The next compatibility hurdle Amdahl encounters may involve hardware more than software. IBM is expected to bring out its next generation mainframe, nicknamed Summit, sometime in the mid-1990s. International Technology Group, a consulting firm in Los Altos, Calif., for one, believes that IBM will diverge sharply from its existing architecture. In 1995, predicts ITG, IBM will introduce a mainframe that merges MVS/ESA, VM (another operating system) and Application System/400, its recently announced follow-on to IBM's midrange S/3X computers. In addition, it will use gallium arsenide (GaAs) processor logic.

Gene Amdahl, the company's founder and current president of start-up Andor Systems Inc., in Cupertino, Calif., does not think hardware changes pose a dilemma. In competition, says Amdahl, "IBM has two responses. One is FUD, or 'fear, uncertainity and doubt.' The other is to keep changing its architecture, but it has been demonstrated that it can be competed with."

For now, though, IBM does not seem concerned with thwarting the PCM manufacturers by radically changing its hardware. "IBM seems to be more concerned with getting its customers into a new environment as easily and gracefully as possible instead of locking out the PCMs," says Peter Burris, an analyst with IDC.

IBM's third response to competition, some might say, could be price cutting. Some analysts believe that may happen more frequently in the early 1990s, when they expect the mainframe business to become more of a commodity business. Amdahl's Zemke concedes that IBM has become more aggressive in its pricing over the past two years, as demonstrated by its 3090S series mainframes. But he doubts an all-out price war would ever happen.

The only scenario Zemke can imagine that happening in, is if Amdahl achieved a significant share of the PCM market. But even then it seems unlikely, says Zemke. "I'd suggest to you that IBM would be looking around to replace the revenue they had lost to us," says Zemke. "That is the very last time you'd really want to get pricey." IBM, adds Zemke, has other problems anyway. "When the PC business isn't growing and its margins are under attack and the midrange business isn't growing and its margins are under attack," says Zemke, "then you look at the mainframe business to bring more to the bottom line."

Amdahl has had its problems, too. In 1982, the company delivered a new generation of systems, called the 580 series. The systems were a fiasco. They had been announced in 1980 and were late. The machines also did not perform as well as Amdahl had reported they would. To exacerbate the situation, the machines were delivered with numerous bugs. According to Bernstein's Martin, Amdahl had to replace about 100 machines after shipping them.

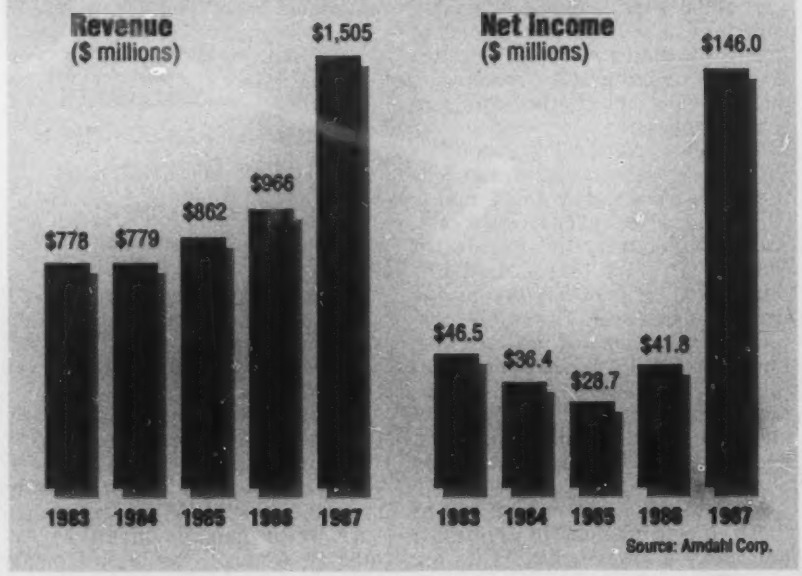
Amdahl's Quality Improvement Process has saved the company about $50 million

After that debacle, Jack Lewis got religion. That's how Roger Heath, director of corporate operations and administration, Quality Improvement Process (QIP), describes the conversion of Lewis, then Amdahl president, to quality management. He hired Phillip Crosby and Associates, a consulting firm in Winter Park, Fla., to improve Amdahl's quality control process after reading Crosby's book, "Quality is Free." The consultant taught 60 Amdahl instructors, who in turn have taught over 80% of Amdahl's workforce, the importance of quality.

Quality isn't free. The consultant has cost Amdahl about $2 million, says Heath. But Amdahl, estimates Heath, has saved about $50 million as a result. The quality program extended well beyond manufacturing departments: for example, Amdahl has cut its accounts receivable in half, saving $18 million in interest expense in one year. Composite production leadtime — from product planning, parts procurement, building and test — has been cut in half, from 66 weeks two years ago to 33 weeks today. The manufacturing cycle time for each board has been reduced from six weeks to 15 days.

Since then, Amdahl's product introductions have been flawless. In 1986, the company began shipping its 5890 mainframes. The systems were on time, performed better than ex-

Amdahl's learned how to keep its net income climbing



Source: Amdahl Corp.

pected and were reliable. By 1987, the 5890 computers accounted for 85% of Amdahl's processor sales, as the 580 series was eventually phased out of production. "Amdahl executed the 5890 perfectly," says Bernstein's Martin. "And it looks like they did the same with the 5990."

The 5990 is the result of Amdahl's first joint development with its Japanese shareholder Fujitsu Ltd. For Fujitsu, the result has been its 2-year-old M780 line of mainframes. But Amdahl contributed about $200 million to the joint development and analysts say the 5990 is not merely a reworked M780.

The 5990 is the first Amdahl mainframe to use very large scale integration (VLSI) semiconductors, supplied by Fujitsu, and an innovative form of water cooling. It also contains the central processing unit on one board, compared with the four boards necessary for the 5890 CPU. Each 5990 board is 42 layers instead of the 14-layer boards used in its predecessor.

According to most analysts, the higher priced 5990 costs about the same to manufacture as the 5890, giving Amdahl generous margins on the machines. But price cutting, in response to IBM's S series, may keep margins closer to the low side.

Analysts expect Amdahl to ship about 50 5990 models this year and an additional 125 next year.

Adding Amdahl value

Over the years, Amdahl has taken a lot of flak over its tight relationship with Fujitsu. Fujitsu supplies all of Amdahl's semiconductors, storage devices, communications processors and some of its components and subassemblies.

But unlike National Semiconductor Corp.'s National Advanced Systems (NAS), another PCM maker which resells Hitachi Ltd. equipment, Amdahl is not a distributor for Fujitsu. In fact, says Amdahl's Springstead, Fujitsu has become an Amdahl distributor. The two companies recently signed a deal allowing Fujitsu to resell Amdahl mainframes in Brazil and Spain. A similiar arrangement, where Fujitsu will market high-end Amdahl models in Japan beginning next March, was inked in September.

Amdahl does not expect any of those foreign markets to contribute noticeably to its revenue. "They are not significant in terms of volume," says marketing executive Springstead. "But it is symbolic. Symbolic of the value we add as a company when you can sell back to your major shareholder gear that embodies a lot of his components in the first place."

In addition, says Springstead, Fujitsu's stake in Amdahl makes for a stable investment environment. A $1.5 billion company, with over $580 million in cash, would normally be ripe for takeover, says Springstead. "A lot of management time would be wasted on worrying about that," says Springstead. "Here we don't even think about it."

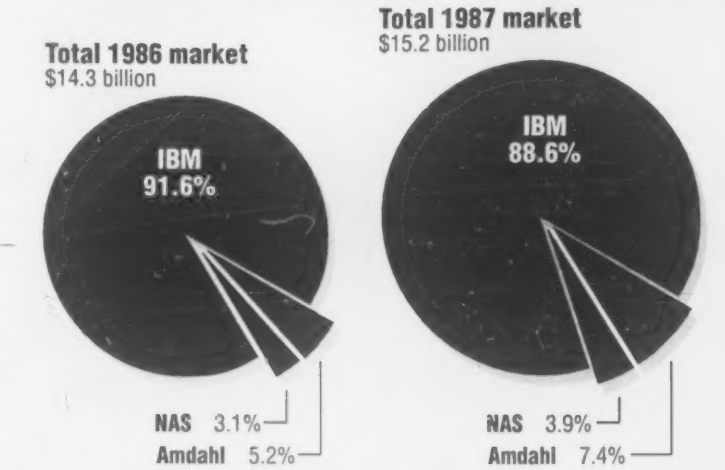
Fujitsu's stake in Amdahl makes for a stable investment environment

Amdahl also offers unique products that differentiate it from IBM. UTS, its Unix operating system, is one example. It is a native operating system, unlike IBM's Unix, called AIX, which must run under VM. Another is Amdahl's Multiple Domain Feature (MDF) announced in 1984. Developed for internal use, as was UTS, MDF allows four separate operating systems to run on one processor. In May, the company enhanced that to seven domains on certain systems. IBM now has a similiar product, called Processor Resource/System Manager (PR/SM).

Displaying leadership, as demonstrated by its leapfrogging IBM in product cycles, impresses customers, too. But while Zemke says he is proud of the company's accomplishment in bringing the 5990 to market quickly, he doesn't want to get trapped into outdoing IBM every time. Staying compatible, after all, is the company's first priority. "Every product has an absolute requirement that it be compatible," says Zemke. The early introduction of the 5990 happened, says Zemke, "because at that particular point in time we were well positioned to take another step. It doesn't say we will always do it."

The immediate future involves catching up with IBM's ESA and delivering compatibility for the operating system on all Amdahl systems. There is also the next generation of hardware to be developed. Says IDC's Burris: "Amdahl is going to be dancing fast and furious for the next three years." □

IBM plug compatible market



Totals may not equal 100% due to rounding

Source: International Data Corp.

Both Amdahl and NAS are gathering market share at IBM's expense

Atten-shun! You will now design ASICs the military way

The Pentagon is mandating VHDL as a standard design language for ASIC contracts. IBM is falling in, but CAE leaders will be tough to recruit

BY DAVID CARD

Starting this month, every custom chip that goes into a Department of Defense system will have to be described in the DOD's new design language. Right now the only tools which allow that come from untried CAE companies. Has the DOD gone contrary to commercial reality again?

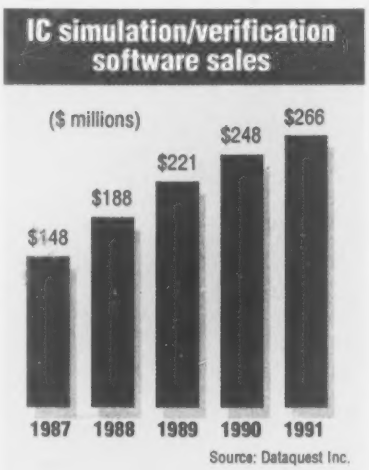
Not so, claim supporters of the language, dubbed VHDL for "VHSIC (very high-speed integrated circuit) hardware description language." In contrast to Ada, the DOD's long-suffering software programming language, VHDL spec-setting was opened to the public early, resulting in an IEEE standard last winter. Nor is there much in the way of commercial competition for VHDL — Ada faced popular and proven programming languages like C and Pascal.

Consequently, firms like National Semiconductor Corp., IBM and Viewlogic Systems Inc. are positioning themselves to cater to a market that, while only now emerging, could be worth hundreds of millions of dollars by the early 1990s.

The issue is one which affects the entire electronics industry, because most observers agree that VHDL will likely be as close as the industry comes to having a single design language, for commercial as well as military use. Should it gain widespread acceptance, VHDL could conceivably double the market for behavioral simulation tools, say some observers. However, there's still debate about how firmly entrenched the new language can become.

A hardware description language (HDL) is used by designers to model a system in a lot of abstract detail. Instead of employing graphic representations of circuitry, HDL defines the system in terms not unlike computer code. This makes for a top-down system design strategy, incorporating "behavioral" simulation — which models the function of a system rather than the performance of individual circuits — as well as more traditional logic and fault simulation.

Even VHDL critics admit that it is a particularly rich language. VHDL allows structural and functional descriptions of all or part of a system — from individual chips to chips on a board to a complete hardware/software combo. John Hines, the VHDL chief out of the VHSIC design group at Wright-Patterson Air Force base, says the DOD will "save literally billions of dollars, long-term," if everybody adopts VHDL. Designs won't have to be redocumented, and different simulators will produce the same results. "The DOD can't do anything with the garbage we're getting — and paying for now," Hines says.



Some say VHDL could quickly double the market for behavioral simulation tools

That garbage is schematics. But getting designers to abandon schematics is going to take some doing. The CAE market is based on bottom-up, graphics-oriented design styles, resulting in schematics rather than computer science statements. Industry-watcher Andrew Rappaport of The Technology Research Group in Boston says that whether engineers will change styles is "the $64 million question." Even Hines has written papers admitting that only 10% of engineers with workstations are familiar with HDLs.

So it is hard to hear anything but lukewarm support for the language from the major CAE vendors. Few custom chip houses are far along in their VHDL efforts either.

There are plenty of other hindrances to wide VHDL acceptance, including the usual technical bickering as well as unapproved subsets of the language and an installed base of non-VHDL tools. There is also an intellectual property protection issue. The DOD wants VHDL so that it can guarantee support for designs, but behavioral descriptions of chips make it easier to copy a design and make a functionally equivalent chip.

It all adds up to an industry quandary. "I'm afraid it might become one of the biggest boondoggles perpetrated on this industry," worries Prabhu Goel, president of CAE simulator company Gateway Design Automation Corp. Goel does not blame the DOD: "Their goals were farsighted. It's the process that is becoming a boondoggle." Gateway does license its own HDL, but not as a competitor to VHDL, says Goel.

Tied hands

Defense electronics giant TRW Inc., a Gateway customer, uses VHDL, but only because it is forced to by VHSIC contract, according to

Horace Bowser, a TRW CAE software engineer. He's had to write add-on programs to compensate for VHDL timing problems. VHDL is too rich and flexible, Bowser says — chip simulation outputs from second source suppliers' versions don't match up.

Still, IBM, for one, has announced support of VHDL. And General Dynamics Corp. would also like to design in VHDL, according to David Evans, who heads electronics design for GD's Data Systems Division in San Diego. "But my hands are tied," Evans mourns. "I'm beating on the tool vendors."

One such vendor, CAE leader Mentor Graphics Corp., is illustrative of the industry's casual attitude toward VHDL. Mentor president Gerard Langeler says Mentor is "not just interested, we are committed" to VHDL, then in the same breath he boasts that Mentor is working on its own proprietary description language as well.

Leading custom chip makers are no more enthusiastic. "Right now, we're not doing anything in response to VHDL," says Van Lewing, software marketing director for LSI Logic Corp. He says he hasn't seen any "hardball tactics" by customers demanding VHDL support. Likewise, VLSI Technology Inc. has little desire to change its internal simulator over to a VHDL-oriented one, according to marketing manager Daniel Skilken. Both companies are planning translators that would generate VHDL descriptions of parts from their simulators — a technique that may not be acceptable to the DOD.

A sampling of VHDL support

CAD Language Systems (Rockville, Md.)
- tool set for developing VHDL to conventional CAE hookups
- start-up, Intermetrics spin-off

IBM (Armonk, N.Y.)
- announced support for VHDL input
- original VHDL contractor

Intermetrics (Cambridge, Mass.)
- full line of VHDL analyzers, simplifiers, simulators
- the original VHDL contractor but little CAE experience

Logic Automation (Beaverton, Ore.)
- third-party VHDL models
- marketing agreements with Vantage, CAE, chip companies

Microelectronics and Computer Technology (Research Triangle Park, N.C.)
- VHDL used in CAE project, working on VHDL verifiers
- CAE project being drastically revamped, for members only

National Semiconductor (Santa Clara, Calif.)
- VHDL models for custom division
- first big player with native VHDL support

Quadtree (Milpitas, Calif.)
- third-party VHDL models
- marketing agreements with Vantage, CAE, chip companies

Seattle Silicon (Bellevue, Wash.)
- Navy contract for VHDL connection to silicon compiler
- compiler company cum design broker

Silvar-Lisco (Menlo Park, Calif.)
- multi-part CAE project: first translators, then simulator
- IBM resells some Silvar-Lisco software

Texas Instruments (Dallas, Texas)
- marketing arrangements with modeling companies
- original VHDL contractor, translations only

Vantage Analysis Systems (Fremont, Calif.)
- VHDL behavioral simulator and front end
- start-up, Silvar-Lisco spin-off

Viewlogic Systems (Marlboro, Mass.)
- simulator with VHDL subset
- marketing agreements for VHDL models

Zycad (St. Paul, Minn.)
- Endot VHDL behavioral simulator in the works
- base in conventional CAE accelerators

Source: ELECTRONIC BUSINESS

Untested players

Wright-Patterson's Hines says that there are plenty of options for pure simulators, but he points out only three — from Intermetrics Inc., Endot and Vantage Analysis Systems Inc. Intermetrics, while a big player in custom software for the defense industry (it was prime contractor for the original VHDL, with subcontracting by IBM and Texas Instruments Inc.), has much less of a record in CAE.

Endot, a Zycad Corp. subsidiary, has 14 beta sites for its VHDL-oriented simulator, but president Mark Parsinen says he doesn't want to "bite the schematic tar baby." That is, Zycad will still support the more traditional graphic methods of design with most of its product line.

Parsinen thinks that VHDL will help to standardize the top-down style of design and could lead to a larger market for behavioral simulation. "It probably doubles or triples the market," he says, which might make for a "conservative quarter-billion dollar market by 1990."

Vantage president Ronald Abelmann is more conservative. He estimates that the behavioral simulation market is a $20 million segment of a $125 million overall simulation market now, becoming half of a $400 million business in five years. San Jose market research firm Dataquest Inc. puts the entire simulation/verification market at $422 million this year, well over half of it hardware, but has not figured out the behavioral or VHDL segments.

One company, CAD Language Systems Inc., is working with some CAE vendors to develop a VHDL front-end for their design systems, and more familiar CAE names like Silvar-Lisco (some of whose software IBM resells) and Viewlogic Systems Inc. are aggressive in their VHDL efforts.

Heavy hitter

And one heavy-hitting chip maker, National Semiconductor Corp., is getting very serious about VHDL. "We're taking the bull by the horns," says Roy McGuffin, design automation director for National's custom business. "We're going to offer VHDL-native models" in the fourth quarter of this year. National is Vantage's largest customer, although it also supports simulators from Gateway and GenRad Inc. National will still resimulate designs that come in in VHDL form — on non-VHDL simulators.

But do these players put enough weight behind VHDL? Analyst Rappaport says that the DOD must meet the industry halfway on two points: to cater to technology-rights worries, it will have to figure out some way of putting designs in escrow — safely locked away until a second source might be needed. And Defense will have to knuckle under and ratify some subsets and make allowances for translations.

When that is done, VHDL may emerge as an industry standard for commercial as well as military designs — a process that could take five years. □

Issues in manufacturing: The view from the top

A poll of 100 vice presidents for manufacturing suggests that the skilled labor shortage could be driving up the cost of blue-collar wages

BY ROBERT SNOWDON JONES

Despite extensive use of offshore manufacturing labor, U.S. electronics firms are continuing to have a hard time finding skilled workers at home, according to the latest ELECTRONIC BUSINESS survey of vice presidents for manufacturing and other plant managers.

The survey is based on about 100 responses to a written questionnaire mailed by ELECTRONIC BUSINESS to close to 1,000 manufacturing managers earlier this year. Six out of 10 managers surveyed said they worked for companies with sales of under $50 million.

Of primary concern to many of these companies was the rising cost of blue-collar wages in the high-technology sector. Our survey indicates that the average per-hour pay for skilled labor in the electronics industry is now $11.30. At the same time, unskilled labor receives an average $7.31 an hour.

Sixty-nine percent of the managers polled also said they would increase salaries 1% to 5% by Sept. 1, 1988. Only 2% said they would increase salaries 6% to 10%, and 7.5% of the respondents said they expected no change in salary levels.

Curiously, though, wages are increasing even though many managers continue to be unimpressed with the productivity of the American worker, compared with his Far Eastern counterpart. Only 7% of our respondents said the American was more productive than the Asian worker. At the same time, thirty-seven percent said U.S. productivity was lower; and 36% said United States and Asian workers are evenly matched.

Our survey also indicated that despite rising wages and complaints about lower productivity, union participation among American electronics workers still remains to be relatively low. From our survey, we found that only 13% of the respondents' plants are unionized. The International Brotherhood of Electrical Workers (IBEW) is the most dominant union. Our respondents reported, too, that unions have tried to organize at 17% of the non-unionized companies polled. As a result of what the poll indicated, the most active unions in the electronics sector included the IBEW, the Teamsters and the United Auto Workers.

Twenty-nine percent of the managers surveyed said their plants use some form of robotics

Jon McIntosh

The overriding concern of American plant managers, our survey suggests, is the availability — or lack thereof — of skilled, versus unskilled, employees. "Guys who are not engineers but are fluent in technology are hard to find," says Christopher J. Ross, vice president for manufacturing for Spectragraphics Corp., a San Diego-based maker of computer graphics workstations. "The ones who are sharp don't stay in manufacturing. The ones that want to get into an electronics career go one step further and go into engineering."

Keeping skilled workers

Because of acute labor shortages in some locations, companies are paying more attention to retaining valuable employees, managers say. And they are finding out that it isn't just direct monetary awards they're after.

"The skilled workers I interview from other companies say they've got a job, but they want a career," says George Irwin, vice president for manufacturing at Appliance Control Technology Inc. in Addison, Ill. "The gray-collar worker is in high demand. He knows it and is looking at quality of life. We try to get them involved and make them feel part of the company."

Labor shortages aren't a universal problem. Much of it depends on geographic area. Kurt Bankord, manager of manufacturing support and depot repair for Phoenix-based Syntellect Inc., says, that getting good technical employees isn't a problem for his company. The Phoenix area has several large electronics installations, including those owned by Intel Corp. and Motorola Inc. It's a perfect hiring ground for a small, fast-growing company like Syntellect, Bankord reports.

That's not the case in the Silicon Valley, where experienced labor is in

Of concern to many managers is the rising cost of blue-collar wages in high-tech

short supply. "Out of every 100 people who apply, 98% are rejected," says Ron Rapczynski, vice president of Engineered Circuit Research Inc., a Milpitas, Calif., medical and military electronics contract manufacturer.

Boom in SMT

One way firms are dealing with the labor shortage is by investing more heavily in new, highly automated capital equipment. Forty-two percent of the respondents to the survey, for example, said they have incorporated some surface mount technology into their operations.

The boom in SMT reflects, in part, the fact that many high-tech firms are rapidly moving up the learning curve in advanced manufacturing technology. Engineered Circuit Research's Rapczynski is perfectly blunt about SMT: "We believe it's where the technology is going."

He says his company is making boards that contain 340 pins with 20-mil centers. "You can't do that with a through-hole part," he says, referring to the older form of inserting components into printed circuit boards. Within the Silicon Valley in the past six months there has been a marked increase in the use of surface mount techniques, he says.

Those companies that have problems manufacturing PCBs with surface mount are in trouble because they don't know how to design the boards, Rapczynski contends. "We prefer to get involved early on in the design stage," he says. "Through-hole is a very forgiving process. Surface mount is metal-to-metal bonding. The best surface mount designs are made by people who build from the manufacturing perspective."

But as the results of the ELECTRONIC BUSINESS poll reflect, not everyone in manufacturing is overwhelmingly enthusiastic about SMT. "Being a new technology, we weren't comfortable with surface mount's maturity," Bankord of Sytellect notes. "We don't think it's completely reliable for our needs," he says. The company's voice response system would require a 30% to 40% through-hole circuit board if surface mount were used, he says. "That's harder to lay out and make than either kind of board. The cost takes away from the attractiveness," says Bankord.

JIT solutions

To offset high manufacturing costs, electronics is also turning increasingly to just-in-time inventory control, a process that involves getting materials and parts to the factory floor "just in time" for manufacture. Seventy-one percent of our respondents said they use JIT to some degree.

"In certain applications it works well," says Irwin of Appliance Control Technology. But components from overseas have to be ordered far in the future in order to use the technique. Low-tech but essential items also don't fit well into a JIT strategy, Irwin says. The corregated boxes the appliance control maker needs are sold by the ton. "I have to buy in large quantities to get a good price," Irwin says.

In addition to JIT, electronics firms are also continuing to experiment in "quality circles." Quality circles were in effect at four out of every 10 manufacturing plants surveyed.

Robotics also appears to be making some headway. Twenty-nine percent of the managers surveyed said their plants use some form of programmable automation. A similar ELECTRONIC BUSINESS survey taken two years ago showed that 22% of the companies had robots.

Some of these statistics about the shift to increased automation may be deceiving, however, some consultants caution. Many companies try these productivity techniques only to abandon them later, said one. "The problem with U.S. companies is, they can't implement these techniques," says Joel Polakoff, senior manager in Chicago for the accounting firm of Seidman & Seidman, which specializes in electronics manufacturing.

Modern efficiency methods fail at many companies, he argues, because of inadequate planning, not because they are not viable ways to gain productivity. American companies are also too impatient to adopt methods that might take four years or more to return their investment. "They

Union participation among American electronics workers still remains low

Jon McIntosh

want it done now and these are long-range systems," Polakoff says. "You can't quantitatively show pay back in short term, so many new ways of doing things don't get tried."

Offshore manufacturing

One trend that does not seem to be abating, however, is the shift toward offshore manufacturing in the cheap labor markets of the developing world. Forty-three percent of the managers surveyed said their companies have operations outside the United States. Mexico is the most frequently mentioned location for non-U.S. plants — with 17 of 40 managers who responded to this question saying they have set up plants there.

Mexico has become popular because of its proximity to the United States and the willingness of Mexican assemblers to work with small U.S. companies, managers said. Also, contract manufacturers are increasingly turning to Mexico to set up operations there.

"The big trade-off of going down to Mexico is that it takes longer to do things down there," according to what Ross of Syntellect says. "You've got more stuff in float."

As an offshore site, Mexico was followed in popularity by eight managers who named Singapore as the main site for their offshore location.

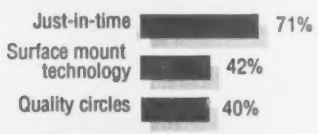
Most of those companies surveyed, however, only do a small portion of overall manufacturing overseas. Fifty-seven percent said they carry out under 10% of their manufacturing operations offshore.

Half of those managers whose companies have offshore plants said they don't expect an increase or decrease in the use of offshore labor over the next five years. Only 5% expect a more than 50% increase. □

ELECTRONIC BUSINESS manufacturing survey

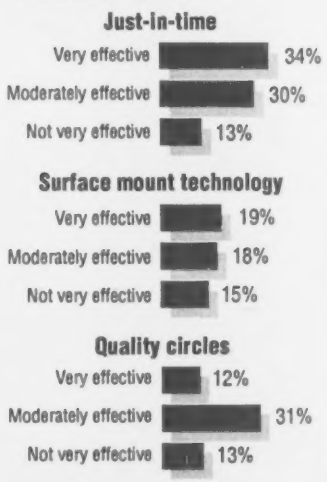
Which of the following manufacturing techniques does your company employ?

Multiple responses allowed

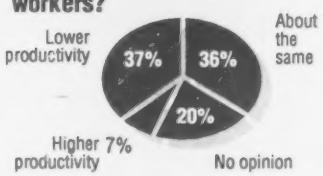


How would you rate the degree of effectiveness for these manufacturing techniques within your company's operations?

Multiple responses allowed



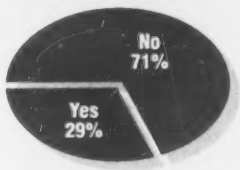
How would you rate the productivity of American versus Far Eastern production workers?



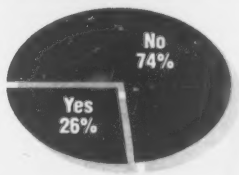
Including benefits, what is the average rate paid to your company's production workers?

Does your company maintain a manufacturing operation outside of the U.S.?

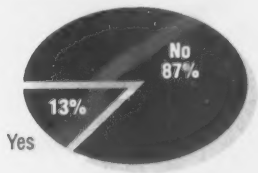
Do you use programmable industrial robots in your manufacturing operations?



Are you experiencing any labor shortages within your manufacturing operations?



Are any of your manufacturing workers unionized?



Source: ELECTRONIC BUSINESS

Disk arrays: Here come the disk drive sextuplets

Disk arrays — rows of disk drives bundled electronically — may be one answer to fault tolerance. It's up to the users to decide

BY JOHN M. DODGE

A disaster looms in data storage — storage devices just can't keep up with the blazing speed of faster and faster central processing units (CPUs). And some disk makers argue that disk arrays — hard disk drives lashed together electronically — may be the down-and-dirty solution.

The problem, of course, is not a new one. Faster CPU speeds are tearing past the ability of storage mediums to serve up data in a timely fashion. As a result, magnetic disk drives are savaging CPU speeds and ultimately the overall speed of computers. And it is faster computers that will give rise to long sought computing applications such as client/server databases, distributed applications and graphics.

As CPU speeds continue to accelerate (40% a year has historically been the rate with single chip computers), storage will fall further behind. Magnetic media is at least three orders of magnitude slower than CPUs and associated memory. According to Sun Microsystems Inc. cofounder William Joy, when CPUs increase tenfold in speed, the computer will only run faster by a factor of five times. Using that same formula, the input/output (I/O) bottleneck reduces a 100-fold CPU increase by 90%, in terms of total computer performance.

Another key to unlocking new technologies is data reliability. Today's technology makes fail-safe data availability and integrity an expensive and inefficient proposition — yet it's frequently as necessary as the computer itself.

Why then, have drive makers and system builders moved so cautiously with disk array technology, a potential answer to both problems? Because disk array must overcome several obstacles, many of them commonly associated with emerging technologies. Industry experts say widespread acceptance of disk array usage must contend with scrawny profit margins, a prerequisite education process to get the market excited, and the ominous presence of the larger computer companies. A more fundamental question is whether the technology represents a new product opportunity or a value-added repackaging of existing disk drives.

Understanding in detail how the technology works requires years of drive development experience, but essentially it involves electronically bundling disk drives, typically six at a time. Typically, too, the drive spindles are so synchronized that all the drives in the assemblage begin logging in data at the same point in time. All of the drives in the array are under the command of the same controller. In this way, blocks of data are "striped" electronically across a group of drives, thereby providing a degree of fault tolerance — computer-based systems that theoretically can't crash and, in the process, destroy data.

Priam's John Titsworth suggests disk arrays could find a niche in CAD/CAM and other applications requiring fast transfer rates

Lane Ericson

Multiple benefits

Disk arrays therefore offer two major benefits — high data reliability and extremely fast I/O or data transfer rates. Typically, one unit is dedicated to storing parity data — codes normally associated with error correction; the other five are for business data. Should one of the five data drives in a six-unit configuration fail, the data can be recreated by a sophisticated error correction algorithm and the parity data. A failed data drive will only slow the system down, but data availability and integrity are maintained throughout.

The technology has been around for some time, but its origins are hard to trace. Some credit Tandem Computers Inc. A more distinct possibility is IBM's so-called "check summing" procedure, which recreates data on failed System/38 and AS/400 disk drives through parity information.

In theory, disk arrays will reduce the bottleneck with high data transfer rate. In doing this, the speed by which this is done is calculated by multiplying the data rate of each drive by the number of units. "Each time you add a drive, you get much higher data [transfer] rates," says John Titsworth, president of San Jose-based Priam Corp., which will be producing disk array products soon. Applications requiring high data rates include graphics, CAD/CAM and databases where large

The disk array market just "ain't there yet," Seagate director of marketing development Carter O'Brien points out

blocks of data are frequently moved.

Disk array and fault-tolerant technologies have also spawned new acronyms, such as mean time between data loss (MTBL) and mean time to data availability (MTDA). Clearly, data storage is advancing the old standard — mean time between failure (MTBF). MTBL can be in the 500,000 to 750,000 hour range. "That's 55 years of continuous operation. Let your children worry about the next failure," quips Chet Baffa, senior vice president for marketing and sales at Micropolis Corp., Chatsworth, Calif. Micropolis is one of two known vendors to have disk array products available on the market.

What's holding the market back is perceived uncertainty over customer need. Paying for fault tolerance you don't need does not make sense. Generally, personal computers (PCs) are not used for fault-tolerant applications, although that is likely to change with the advent of Intel 80386 database servers under OS/2, the new IBM PS/2 operating system. At OEM pricing, disk array requires special error-correction software, a master controller and spindle/actuator synchronization, all of which can more than double the cost per megabyte of 3.5-inch and 5.25-inch storage from its current lows of $3 to $5 per megabyte. End-user pricing — as high as $24 per megabyte, according to San Jose-based market research firm Dataquest Inc. — is exorbitant.

Fears abound

Another fear facing drive makers in particular is that disk array technology will be implemented by the large systems makers such as Digital Equipment Corp., IBM and Tandem, thus eliminating a sizable chunk of their potential market. "It's a replay of the floppy disk market. When it becomes big volume, they will want to do it themselves," says Micropolis' Baffa. Jim Porter, president of Disk/Trend Inc., a Mountain View, Calif., research concern, agrees: "Some of the companies that have been pioneering in this area have become discouraged. Generally, it is expected that most mini makers will do their own thing with [disk arrays]."

So far, though, the big computer makers do not appear to be taking the plunge. A Tandem spokesperson would only say that the company is "investigating the possibility." A Digital Equipment Corp. spokesperson says the company "considers all good technologies." However, the recent introduction of SA600 large disk drives incorporating a "predicted maintenance" fault-tolerant approach indicates that as far as DEC is concerned, disk arrays are a ways off, says Gerry Atterbury, vice president of peripherals at Dataquest. Even though DEC calls them "arrays," they are actually 1.2-gigabyte drives that are clustered together with software that indicates when something is amiss. Then an operator can shut down a unit or replace it.

The sum of its parts

IBM implements what it terms a check summing scheme, which differs from disk arrays, according to Brian E. Clark and Terrence J. Stewart, two of five inventors named on a patent application to protect part of the process. For example, it does not require disk synchronization; and rather than put parity data on one drive, IBM spreads it over several drives, Clark and Stewart explain. Both are programmers at IBM's Rochester, Minn., disk drive complex.

The advantage, they point out, is that their version does not tie up all the drives, and as a result can do many simultaneous read and writes; disk arrays, on the other hand, read and write data one block at a time, giving it the effective transaction processing rate of only a single drive, albeit at very high data transfer rates. Until disk arrays can get around this problem, they will probably be de-

Liane Enkelis

Auspex founder Larry Boucher believes disk arrays only represent an opportunity for companies already anchored in the drive business

nied another piece of the market — that of processing high volumes of small bits of data. Disk arrays, on the other hand, won't crash a system, whereas IBM's process will. Either way, they perform the critical task of data recovery. But as for broader disk array technology, IBM reserves comment on its position — although some experts, such as Atterbury, believe IBM's again aging 3380 large disk drives would be an ideal target for it.

Search for the mainstream

Even though a healthy distance between disk arrays and big computer companies exists for now, Micropolis, says Baffa, is considering shelving the technology. Currently, the company is test marketing a 1.5GB workstation and mini-configuration made up of four 380MB data and one parity unit. The drives are 5.25-inch with SCSI interfaces. "If we conclude it cannot be mainstream enough, we will probably pull back," says Baffa. He declines to name distributors and value-added resesellers (VARs) interested in the product, but judging from Micropolis' experience, the response has been less than enthusiastic.

"I have not even heard of [disk arrays]," says Preston Heller, chairman of Pioneer Standard, a Garfield, Ohio, disk distributor. Heller points out that the drive market, especially for PCs, is a volume commodity market where margins are razor thin or even nonexistent. "It's very competitive," he notes.

"'It's really hard to say whether or not this is a market,' according to some experts. How much value is added actually doing this? A disk array is really a disk drive with certain characteristics and potentially better

Disk arrays offer two major benefits — high data reliability and fast data transfer rates

performance. Does the customer want to pay the added tariff? I don't really have a sense for that yet," according to Larry Boucher, president and founder of Auspex Inc., a Santa Clara, California, start-up that will probably employ disk array technology, but not base its business on it. Boucher is the founder of disk drive controller maker Adaptec Inc. and the inventor of the SCSI peripheral interface.

Disk arrays only represent an opportunity for companies already anchored in the systems or drive business, Boucher posits. A company basing an entire business plan on it has a lower chance for survival, he says. "How do you get in between drive and systems companies and make money?" he asks. Pacstor Inc., of Los Gatos, Calif., is trying to do exactly that. Bucking the odds, 1-year-old Pacstor is selling into the largely non-fault-tolerant PC marketplace and is neither a systems nor a drive maker. Rather, it buys drives, adds value with error-checking software and controllers and resells them as disk array subsystems.

Pacstor recently started shipping three versions of its Integra array storage subsystems. Using 3.5-inch drives, the high-end Pacstor system boasts an access time of 4 milliseconds, a data rate of 1.25MB per second and a mean time between data loss of a whopping 750,000 hours (85 years). Prices on the high-end Integra III with 12 100MB drives and 80386 intelligence to handle up to 16 microcomputers, start at $9,000 in 750-unit quantities. With networks at the forefront of PC fault tolerance, Pacstor smartly has made the line compatible with Novell Inc. and 3Com Corp. network operating systems, as well as PS/2s, PC ATs and Unix.

Keep it simple

"The sales effort to educate the prospective customer base regarding the benefits of array processing will be expensive. Yet, Pacstor has a chance to make it big," writes Dataquest analyst Phil Devin in a newsletter. Devin pegs end-user cost per megabyte at as high as $24.

Pacstor is the creation of John Kevill, a 30-year veteran of IBM, DEC, Storage Technology Corp. and Memorex disk drive adventures. He lists relevant PC applications as transaction processing, desktop publishing, CAD/CAM, telecommunications, military programs and process control.

At a demonstration at Spring Comdex in Atlanta, one of 12 drives was unplugged and one-twelfth of the picture on a PS/2 Model 80 monitor disappeared. Another was unplugged and another twelfth vanished. When the error correction was activated, the entire picture was restored.

Still, Pacstor and Micropolis stand

Lane Erickson

alone in the small computer market. Analysts agree that if client/server databases and mission critical applications on PCs become reality, and there is every expectation they will, Pacstor can cash in on visionary status. It's too early to tell what success Pacstor is enjoying and Kevill declines to release distributor or OEM customers who are just receiving the product. Either way, Pacstor should be able to hang on for some time, given that its major backer is established keyboard maker Key Tronic Corp., which will do manufacturing and provide support.

Besides Micropolis and Pacstor, activity on the PC side is in its early stages. On the minicomputer and mainframe side, disk arrays seem to be getting on track. "We are actively evaluating the array business and looking at smaller diameter drives to develop high performance," says Errol Heiman, intelligent peripheral interface (IPI) product manager for Fujitsu America Inc.'s Intellistor subsidiary in Longmont, Colo.

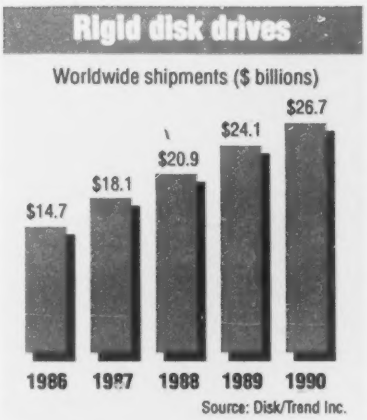
A low-end explosion

The explosion in demand for 3.5-inch and 5.25-inch drives has driven cost down so far that when configured in disk arrays, they represent a less expensive solution than less reliable and slower single versions of 8-, 9-, 10.5- and 14-inch drives, according to Amil Vasudeva, director of system products for Fujitsu in San Jose. This year, 3.5-inch drives will pass 5.25-inch drives in volume at an 8 million crossover point.

By 1990, more than 20 million 3.5-inch drives will be shipped. Quantities for the larger diameters will all be under 500,000, with 5.25-inch drives dropping to about 4 million, according to Disk/Trend.

For a 3.5-inch drive, OEM prices are reportedly in the area of $3 to $4 per megabyte in volume orders. Fujitsu believes the technology has a bright future, but is not ready to commit to it. "I think Micropolis is ahead of the market by about two years. There's a lot of concern about 5.25-inch and 3.5-inch [drive] reliability, and that they can't tolerate the high data rates," Heiman says.

Thus, optimally configured array systems have the potential to shatter the I/O bottleneck issue and enable systems to realize their processing potential. The largest volume producer of 5.25-inch hard drives, Seagate Technology Inc., is more cautious. "It ain't there yet. You don't want to get all sucked up into vendor hype. I'd say we are more at the R [research] stage than the D [development] stage," says Carter O'Brien, Seagate director of market development. As mini and mainframe applications such as communications, graphics and number crunching migrate to PCs during the next two years, a genuine need for disk arrays will emerge, he says.



While disk arrays are attractive because of their fault-tolerant capabilities, they still represent well under 1% of all rigid disk drives shipped this year

Disk arrays are certain to be recognized as one solution to the I/O bottleneck

Control Data Corp. also is being cautious. "There is no one disk subsystem suited for all applications. In choosing a storage solution, systems integrators must address the important attributes for specific applications and should deal with formatted capacity, data rate and cost," writes Al Sharon, manager of technical sales support in Control Data's Storage Products Division, in a report called "Disk Array or Disarray?"

What bothers Sharon is formatted data storage efficiency. In an array for four data drives (and one parity), 512K sectors of data are split into four 128K sectors, one for each data drive. Given that each sector carries the same amount of "overhead" data (data associated with formatting), formatted capacity for data drops from about 85% for a single drive to 64% in a disk array. However, that's a lot better than the standard 50% for fault-tolerant shadowing, Sharon notes. "We are not offering it," he says, but the chances are that Control Data eventually will. Like the others, Sharon sees arrays best suited for graphic and CAD/CAM applications. Fault-tolerant and single drive configurations are better suited for transaction processing and general business applications when it comes to cost and performance.

Striving for efficiency

A strong disk array supporter is Amperif Corp., of Chatsworth, Calif. "We are very enthusiastic, but we'll be in the mini and mainframe market, not the PC market," says Steve Fuld, vice president of business development and strategy. Amperif is developing an IPI controller and expects a warm reception from mainframe system and drive makers. "For such specialized applications like image processing, you need high data rates for large I/O transfer. It's not a PC market... [IBM PC] ATs cannot handle high data rates," Fuld explains. Potential customers include Fujitsu, Gould Inc. and Unisys, Fuld adds.

Sequent Computer Systems Inc., a Beaverton, Ore., supplier of Unix minis for transaction processing, is also optimistic. "Unlike some systems makers, it will look to the outside for the technology," says Mike Altree, I/O systems manager at Sequent.

At some point, disk arrays are certain to be recognized as one solution to the I/O bottleneck. For now, however, the bottleneck is more in the minds of engineers and academics than the market psyche. With some education, increased emphasis on the small computers and recognition that new applications are vital in keeping America competitive, disk arrays have a place. For the pioneers with vision, guts and the smarts to find out where the shoe fits best, there should be a payoff. □

Precocious desktop publishing gets growing pains

A new industry faces an old problem. Desktop publishing equipment makers, like other high-technology businesses before them, are facing a shakeout

BY STEVE GROSS

Although scarcely 2-years-old, the personal computer desktop publishing industry already is looking to the future. Indeed, in a market that some believe will move from birth to maturity in only five short years, the shakeout phase of the cycle may already be approaching.

That's because so many competitors have been drawn to a field where rapid growth has been fed by lower prices for essential computer equipment, particularly laser printers. Creative Strategies, a Santa Clara market research firm, predicts that the desktop publishing market will reach $2 billion this year and $5 billion in 1992. Software and hardware sales are about 30% and 70% of the market, respectively.

Software side

The software side of the desktop publishing market is dominated by Xerox Corp.'s Ventura Publisher and Aldus Corp.'s PageMaker. By their own estimates, the two equally share from 80% to 95% of the dedicated desktop publishing software market for MS/DOS machines.

Perhaps 20 or 30 smaller software firms, such as Letraset of Paramus, N.J., compete for the rest of the market. Letraset, for example, claims to have 28% of the Macintosh portion of the desktop publishing software market; software for the Macintosh may, in turn, constitute a third or more of the total desktop publishing software market. Software vendors say that there's room at the top for a few more key players, but not many.

"I think there will certainly be more than two desktop publishing companies, and probably three or four," says Carolyn Grossman, San Diego-based manager of customer support and documentation for Xerox desktop software. She predicts that Xerox and Aldus will be among the top competitors, and notes that Interleaf Inc. of Cambridge, Mass., a player in the high-end workstation market, also may become a force in PC desktop publishing. Other competitors, she contends, must overcome "the stranglehold on the market" by Xerox and Aldus.

Some smaller players may survive as niche marketers or as product development houses for larger firms with more marketing clout. Xerox has fostered the latter strategy by using marketing agreements with third-party development firms including Ventura Software, developer of Ventura Publisher, and more recently Cricket Corp., a Malvern, Pa., creator of graphics and drawing programs.

Grossman says Xerox expects industry-wide dedicated desktop publishing software revenue to reach $120 million in 1989. "I don't think this market will even start to flatten until 1990," she says. "Then year-over-year growth will start to slow down." Growth will plateau in the early 1990s, she predicts.

Tim Bajarin, executive vice president of Creative Strategies, isn't ready to predict a shakeout in desktop publishing. But he points out that dedicated desktop publishing software firms like Xerox and Aldus can expect more competition from well-established word-processing programs such as Microsoft Word and Word Perfect. Those programs might tap into the low end of the desktop publishing market with additional features, he says.

"All the word-processing guys are aggressively adding desktop publishing to

Peter Poulides

Xerox's Carolyn Grossman: "I think there will certainly be more than two desktop publishing companies"

their programs," according to Bajarin. "And all of them have a strong installed base of products [to which] they can sell upgrades." As a result, he says, the dedicated desktop publishing software firms may be forced to upgrade their own programs to keep ahead of the word-processing firms.

Technical barriers

But Xerox and Aldus aren't worried. They argue that word-processing firms face formidable technical barriers in merging the disparate functions of text manipulation and page layout. For one thing, Grossman asserts, the file formats of word-processing packages are too restrictive. "Those formats are optimized for manipulating text, not for formatting it" to appear on a printed page, she says. "They are no competition for serious desktop publishing software."

Jill Bamburg, director of marketing for Aldus Corp. in Seattle, agrees. "I don't think [word-processing packages] can get to be true desktop publishing packages," she says. "Text entry and page composition are too different."

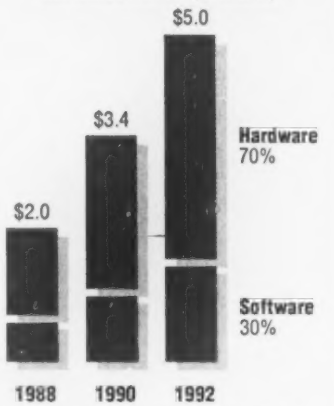
Lisa Wellman, a spokeswoman for Letraset (publisher of Ready,Set,Go!, a $495 package for the Macintosh), says desktop publishing software is headed toward more specialization, not broad general-use software such as enhanced word-processing programs.

Vendors insist that dedicated desktop publishers have an attractive future because they haven't really penetrated their existing markets yet. "Our primary market is the graphic arts community, and that has only been penetrated by 4% or 5%," according to Wellman.

"We have barely begun to touch the power users of desktop publishing, the people in corporations who do technical documentation for company products," concurs Grossman. Ventura Publisher's primary customers are small companies with annual revenue of less than $30 million. "Most are doing newsletters and brochures; some are doing manuals. A lot of them are doing hardware and software development," she says. "Major corporations are just starting" to use Ventura, according to Grossman, who predicts that in 1989, the mix of sales will shift in favor of large corporate customers.

Desktop publishing

Worldwide market ($ billions)



Source: Creative Strategies

Xerox claims that Ventura Publisher, which sells for $895 in the IBM-compatible market (it isn't available on the Apple Macintosh), offers two distinct advantages that keep the company in a leadership role: speed and a technique for rapidly adding specific type styles to page layouts.

> **"There are too many competitors, and there probably will be some kind of a shakeout in the near term"**
>
> **Thad Webster of Hewlett-Packard**

Grossman says that Ventura computes page layouts at the relatively high rate of 20,000 characters per second. While Xerox considers Aldus its chief competitor, Grossman contends that Aldus' PageMaker is, by comparison, "painfully slow . . . but they have a powerful marketing organization that's keeping them afloat. In fact, they do very well."

Bamburg argues that PageMaker's speed "is entirely dependent on what you're trying to accomplish. For many users who are going from start to finish on a project, our product is faster than [Ventura]. . . . In general, the market considers our package to be easier to use than theirs." The MS/DOS version of PageMaker sells for $795 and the Macintosh version for $595.

Despite their disagreements, the two leading firms in desktop publishing software give the hardware vendors some of the credit for the rapid growth of their market. "Desktop publishing couldn't have come into existence without laser printers," says Grossman. "Today, the fact that there are more and better laser printers and color printers just fuels our business as we fuel theirs."

Decreasing hardware prices also are creating new opportunities for desktop publishing software vendors. "Now that schools and institutions can afford hard disk drives, a whole market segment is opening up," Grossman says. Adds Bamburg: "as 80286 and 80386 PCs come down in price it helps desktop publishing along."

Hardware market

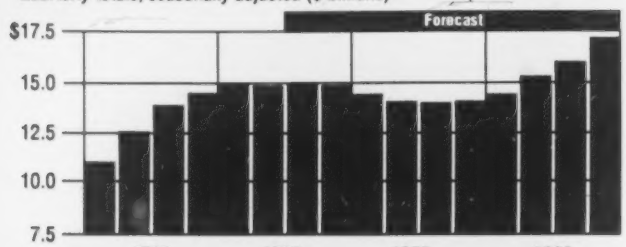
It's harder to identify the leaders in the hardware market, which is made up of a diverse set of manufacturers making laser printers, monitors, computers and accelerator boards. But companies like Hewlett-Packard Co., which makes laser printers at its facilities in Boise, Idaho, have seen the number of competitors skyrocket.

Thad Webster, product planning manager for Hewlett-Packard desktop publishing laser printers, which start at $2,695, says that "the visibility given to desktop publishing has helped to accelerate the number of vendors in the market with laser printers." Soon after HP introduced its first 300 dots-per-inch laser printer in 1984, there were between 10 and 20 competitors, he notes. Now there are nearly 50 competing firms.

While strong growth in desktop publishing laser printers is expected into the 1990s, Webster says he thinks that "there are too many competitors, and there probably will be some kind of a shakeout in the near term." Some vendors may avoid the appearance of a retreat by keeping a desktop publishing laser printer in their product lines while relying on other models to generate sales, he adds. □

Electronic components — New orders

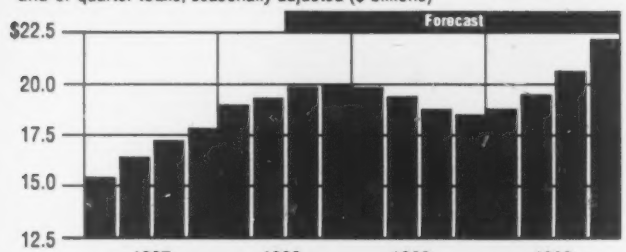
Quarterly totals, seasonally adjusted ($ billions)



SIC 367 Historical data: U.S. Commerce Department; Forecast: Cahners Economics

Electronic components — Unfilled orders

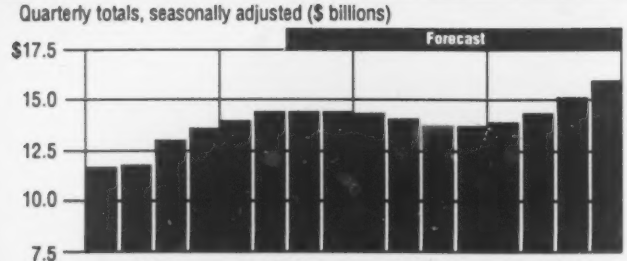
End-of-quarter totals, seasonally adjusted ($ billions)



SIC 367 Historical data: U.S. Commerce Department; Forecast: Cahners Economics

Electronic components — Shipments

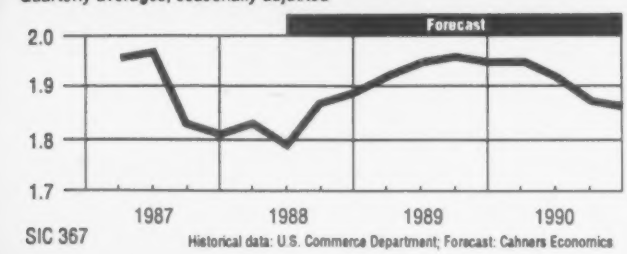
Quarterly totals, seasonally adjusted ($ billions)



SIC 367 Historical data: U.S. Commerce Department; Forecast: Cahners Economics

Electronic components — Inventory-to-shipments

Quarterly averages, seasonally adjusted



SIC 367 Historical data: U.S. Commerce Department; Forecast: Cahners Economics

Component makers put 1989 into perspective

After the disappointing ups and devastating downs of the past three and a half years, manufacturers of electronic components appear ready to panic at the slightest hint of bad news. Well, yes, the latest statistics do confirm that the U.S. components industry is heading down. The U.S. economy is probably not going to grow as strong in 1989 as it did in 1988. And, yes, that means capital investment will retrench and component demand will weaken.

But few economic forecasters expect 1989 to be a recession year, no matter which president is elected. Growth will slow down, not tumble down. That will set the stage for a muted business cycle in industrial markets. A panic mentality will hurt component makers in 1989, not help.

What do the latest statistics mean?

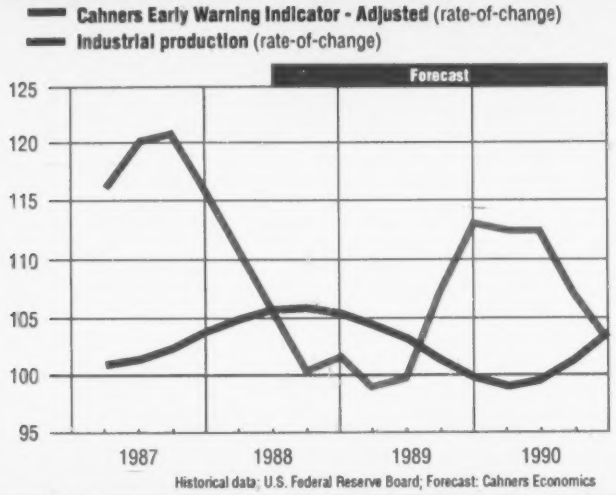
U.S. factories reported $14.8 billion worth of component bookings in the second quarter of 1988. This represented a 0.6% drop from the first quarter, the first quarterly decline since early 1987. Still, shipments of components totaled $14.5 billion, which was a 3.8% quarterly gain and a 23% year-ago gain. By the way, that year-ago increase was the best since November 1984.

The increase in shipments and slowing growth in billings is typical at the current stage of the business cycle. Growth in backlogs has begun to slow down and inventory growth has picked up.

All these statistics were expected. The lack of surprises means there will be no unexpected imbalances in the supply/demand conditions in the components industry. The coming slowdown will be very slow. For example, component shipments are expected to remain relatively level in the $14.5 billion range during the second half of 1988. That will mean a 14% overall increase in shipments in 1988, for a total of $57.3 billion. Then, in 1989, shipments will fall gradually to $13.7 billion in the fourth quarter. By the year's end, shipments will have fallen only a modest 3%. In 1990, shipments are expected to regain strength rapidly.

If the forecast has a risk, it's probably on the up-side. With inventories still so low, the industry may only experience a no-growth scenario next year. So, what's there to worry about? Sure, the industry will not see double-digit growth in 1989, but economic business cycles are a fact of business life. The fact for next year is that the business cycle won't drag the industry into a deep, dark recession; it will only cause a momentary pause in long-term growth.

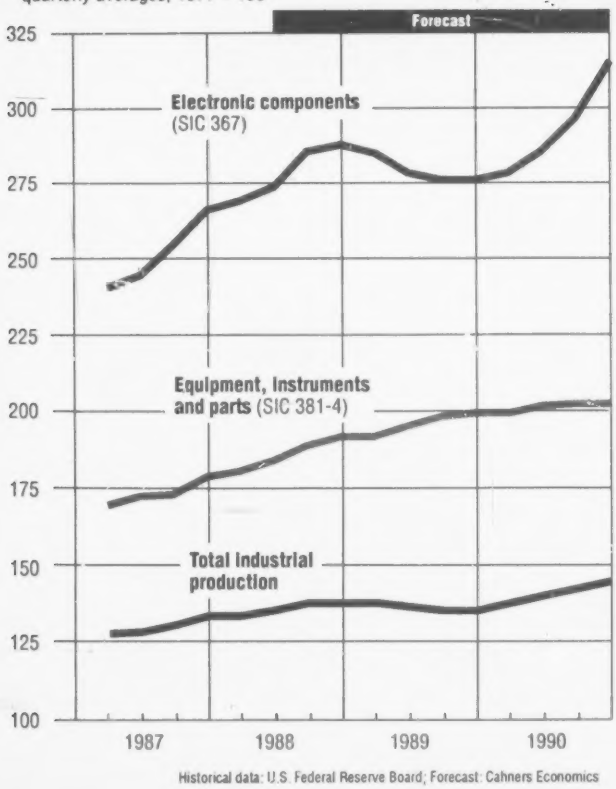
Economic indicators



Historical data: U.S. Federal Reserve Board; Forecast: Cahners Economics

Components and instruments — Industrial production

Industrial production indexes, seasonally adjusted quarterly averages, 1977 = 100



Historical data: U.S. Federal Reserve Board; Forecast: Cahners Economics

Higher inventories of imports may slow growth

The indicator peaked in the third quarter of 1987 and is heading for a low point in the second quarter of 1989. But the downturn will be mild and short-lived, according to the CEWI readings. The growth expected in U.S. industrial production has been revised downward slightly for 1988 by Cahners Economics. So, instead of slowly accelerating growth this year, industrial output will hover around the 5.1% to 5.9% range all year, before heading down in 1989. The reason for the revision? Inventories of imported goods are high. This could result in greater import price competition and U.S. manufacturers could feel the heat. Still, export growth and renewed business investment will steer U.S. industry to steady growth gains this year.

Instrument output continues to climb

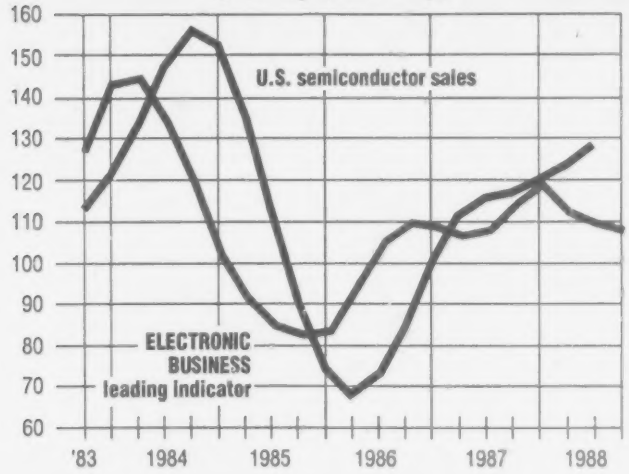
Output from scientific and engineering instruments manufacturers continues to rise at an easy, steady pace. An ongoing stream of orders and relatively high levels of backlogs will continue to beef up production through the remainder of this year. Growth is expected to dwindle afterward as businesses pull back on their capital equipment purchases. However, the corporate push for increased efficiency and quality will most likely mean a greater share of investment spending on test, measurement and inspection equipment and process control instrumentation. Cahners Economics forecasts production increases of 6% in 1989 and 3% in 1990.

Business cycle caps components growth

Electronic components output at U.S. factories grew a modest 1.9% in the second quarter of 1988, according to the Federal Reserve Board. That pace was short of the projected 3.4% rate, which means inventories of components continue to be held at extremely low levels. Apparently, caution is the guiding principle for 1988 production schedules. Component output must pick up pace in the second half of 1988 in order to fulfill a projected 11% growth by the end of the year. A minor 0.2% decline is expected in 1989. But if production growth is slower this year, then expect a slight output increase next year. The forecast for 1990 is for more of the same: 6% growth in 1990 will mark the upswing in the next business cycle. Without a sharp downturn in 1989, production growth in 1990 will not see double digit gains.

ELECTRONIC BUSINESS leading indicator

Quarterly (rate-of-change)



The ELECTRONIC BUSINESS leading indicator predicts turning points in U.S. semiconductor sales with about a three- to nine-month leadtime. For more information please contact Elizabeth Baatz, senior economist, Cahners Publishing Co., 275 Washington St., Newton, Mass., 02158, or call (617) 558-4368

Monthly (rate-of-change)

The ELECTRONIC BUSINESS leading indicator has barely budged in the last three months. But the plateau will yield to further downward drifting by this fall. Slowly and steadily, the mild downturn in the indicator presages a modest downturn in semiconductor sales in 1989.

Source: Cahners Economics

Electronics industry indicators this month

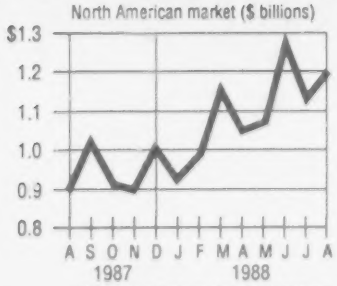
	Latest month	Previous month	Year ago	1987 average
ELECTRONIC BUSINESS leading indicator (rate-of-change, July)	108.3	108.5	109.7	111.1
U.S. semiconductor bookings ($ millions, 3-month average, Aug.)	$1,209	$1,260	$964	$951
Weekly hours of semiconductor production workers (monthly average, July)	40.4	40.1	40.9	40.6
Electronic components leadtime index (1977 = 100, Sept.)	114.6	117.9	103.8	100.7
S&P's semiconductor stock price index (1970 =10, monthly average, Aug.)	54.1	61.1	77.9	65.5
Change in electronic components inventories ($ millions, SA, July)	+$145	+$88	+$32	+$41
Contract and orders for plant and equipment ($ billions, SA, July)	$39.7	$40.1	$37.5	$34.6

SA = seasonally adjusted, all other data is not seasonally adjusted

Sources: Semiconductor Industry Association, U.S. Bureau of Labor Statistics, *Electronics Purchasing* magazine, Standard & Poor's, U.S. Commerce Department, U.S. Bureau of Economic Analysis

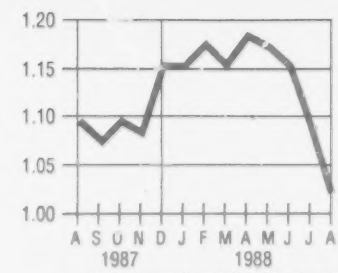
Semiconductor sales

North American market ($ billions)



Source: Semiconductor Industry Association

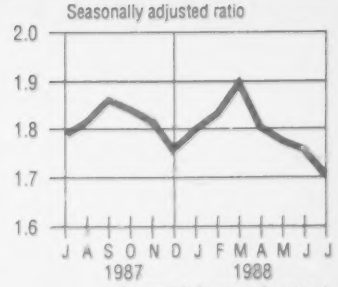
Semiconductor book-to-bill ratio



Source: Semiconductor Industry Association

Component inventory-to-shipments

Seasonally adjusted ratio



Source: U.S. Commerce Department